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Matrix Accounting Using for Employee Training and Development

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Abstract

This study explores the recent adoption of matrix accounting as a game-based learning (GBL) tool for training and development. We administered an open-end survey questionnaire to the participants of a Management Game (MG) workshop using matrix accounting to obtain score sheets, and performed inductive research based on an exploratory analysis of the data to examine the characteristics of MG that uses matrix accounting. The results show that matrix accounting is an effective learning and development tool. In addition, our findings are also used to build a theoretical construct indicating which characteristics of matrix accounting contribute to the development of accounting skills and knowledge.

1. Introduction

Giovanni Rossi conducted the first studies on matrix accounting in the early 1900s. Between the 1960s and 1980s, many studies addressed this accounting technique (Rossi, 1998; Mattessichi & Galassi, 2000; Hughes, 2016). However, the research on matrix accounting has not been widely incorporated into the practice of accounting. Although researchers predicted an evolution in accounting practices and teaching incorporating matrix accounting, this change has not materialized (Mattessichi & Galassi, 2000; Hughes, 2016). Nevertheless, matrix accounting has been adopted in Japan, particularly for training and education activities. This study aims to explore the recent adoption of matrix accounting as a game-based learning (GBL) tool for business training and development.

The motivation for this study stems from the accounting literature that does not appear to reach a consensus regarding the efficacy of teaching double entry bookkeeping (DEB) in introductory accounting courses (Greig, 2018; Sangster, 2010; Pincus, 1997; Saudagaran, 1996; Keef & Hooper, 1991). Several previous studies contend that accounting novices tend to find DEB boring and difficult (Sangster, 2010; Saudagaran, 1996). These authors contend that the technical aspects of DEB promote negative perceptions of accounting and foster the wrong mindset, which in turn attracts untargeted students to the profession (Greig, 2018;

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Pincus, 1997; Saudagaran, 1996). In contrast, other research emphasizes the importance of teaching DEB in the introductory stages of accounting education. For instance, Sangster (2010) indicates that knowledge of DEB facilitates the development of high order thinking skills, especially when people start learning it at an earlier stage of tertiary school. Others argue that the efficacy of teaching DEB depends on where it is best taught, namely, university or the workplace (Greig, 2018). In this study, by including matrix accounting as an alternative option, we question whether the DEB paradigm should be replaced altogether.

In Japan, the accounting literature acknowledges Koshimura (1969), who translated a collection of papers by several North American authors into Japanese, as the first source of matrix accounting knowledge (Mattessich, 2005). Koshimura's manuscripts significantly contributed to the application of matrix accounting in business practice in Japan. Drawing from Koshimura's works, Nishi invented a table-top-type GBL tool based on matrix accounting called Management Game (MG) (Nishi, 1988). Since 1976, Nishi has been leading a workshop for business training based on MG (Nishi, 1988). As a result, in recent years, several workshop participants have begun adopting matrix accounting in their own business practice as an alternative to DEB, especially for training and educational purposes.

Using the results of an open-end survey questionnaire administered to the participants of MG workshops, this study performs inductive research based on exploratory analysis to examine the characteristics of matrix accounting used in the MG. This study also reveals several characteristics of matrix accounting, thus contributing to accounting skills and knowledge.

The remainder of this paper is organized as follows. Section 2 reviews the related literature. The research design, including a brief description of MG and the history of matrix accounting, is described in Section 3. The results of the analysis are reported in Section 4. Section 5 interprets and discusses the results, and Section 6 concludes.

2. Literature Review

The literature on matrix accounting in the 20th and 21st century is based on perfect square matrices known as "perfect chessboards" (e.g., Corcoran, 1964; Ijiri, 1988; Mattessich & Galassi, 2000). According to this format, each row and column is labelled with headings indicating the company ledgers to record transactions.

The idea of using matrix accounting in education is not new. In the 1960s and early 1970s, several researchers published studies that attempted to use matrix accounting for education purposes. For example, Faux (1966) proposed using matrix accounting to teach introductory accounting courses at universities in order to prevent student confusion regarding the seemingly contradictory meaning of debit and credit. Using matrix accounting resolves this apparent contradiction, making the terms simpler and more intuitive to

understand. In matrix accounting, "plus" always means "increase" for both asset and liability accounts, and "minus" always means "decrease." The author argues that the simplicity in the recording of transactions in matrix accounting helps novices quickly learn the fundamental processes of understanding, interpreting, and classifying transactions (Faux, 1966). Similarly, Corcoran (1964) suggests that universities should teach matrix accounting bookkeeping techniques based on its own merits. That study points out that the adaptation of matrices to bookkeeping saves time and eliminates common bookkeeping errors. He also acknowledges that all requirements of traditional worksheets may be comprehensively fulfilled by a single matrix sheet requiring significantly less work, figures, and time (Corcoran, 1964).

More recently, Vysotskaya et al. (2016) incorporate a matrix algebra approach into an introductory accounting course titled "Accounting and Analysis" at a Russian university. The authors illustrate that, in contrast with the traditional double-entry bookkeeping system, the matrix modelling approach can adapt to different accounting record systems, registers, and algorithms for data transactions in terms of processing and reporting, which are often required in real-world accounting systems. They also demonstrate the validity of using the matrix approach in classes on accounting theory with respect to alternative accounting choices, and highlight how this approach can make problem-solving more central to student learning. This result is a noteworthy contribution to the debate in the accounting literature, which does not seem to have reached a consensus regarding whether teaching DEB allows learners to effectively develop their higher cognitive and thinking skills (Creig, 2018; Sangster, 2010; Pincus, 1997; Keef & Hooper, 1991).

However, the studies referred above primarily address the impact of matrix accounting on student learning in higher education. Little research has been conducted on the effect of matrix accounting as a learning tool for business training and development outside of a formal education setting. This is an issue of great relevance in the accounting literature, since prior studies have only argued whether formal education or the workplace is the best setting for accounting education, without questioning the suitability of bookkeeping (Craig, 2018). Furthermore, there is no empirical research conducted with data collected from practitioners who have experience using matrix accounting, because MG is the first case to have adopted matrix accounting for the purpose of business training and education.

3. Research Design

3.1 Inductive Exploratory Study

This study performs inductive research based on exploratory analysis to investigate the characteristics of MG, which uses matrix accounting in the context of business training. Inductive research generally begins with data observation and seeks to identify relations and

patterns in the data, from which theories may then be developed (Hyde, 2000). The technique applied in this research is thematic analysis, defined by Braun and Clarke (2006) as a method for identifying, analyzing, and reporting patterns as themes in the data. More specifically, a theoretical thematic analysis (Boyatzis, 1998; Braun and Clarke, 2006) was conducted. This type of analysis tends to be driven by the researcher's theoretical or analytic interest in a specific area, such as the research question in this study. The deductive type of theoretical thematic analysis is thought to be less suitable for providing a rich description of the data but is better for analyzing detailed aspects of the data (Braun and Clarke, 2006). Given this contextual background, we employ the thematic analysis method as illustrated by King and Horrocks (2010).

3.2 Management Game (MG) using Matrix Accounting

To address our research purpose, we focus on the MG as a GBL tool that incorporates matrix accounting. Regarding the development of MG, Nishi (1988) was motivated by the ambition to provide better opportunities for employees to learn fundamental ideas, knowledge, and skills related to business management. He worked as secretary for the CEO of Sony Corporation from 1967 to 1969. Soon, he realized that most employees in the company did not know the basic principles of accounting and business. He was strongly convinced that company performance would be significantly improved by allowing both employers and employees share views on how to manage a business. However, in reality, this was far from achieved. Nishi was frustrated by the fact that employees were not provided any corporate training, and his distress motivated him to develop the MG. He developed the game by the end of 1975, and began using it for internal corporate training at Sony Corporation. Later, he began to sell the game set publicly as a general training tool.

MG is categorized as GBL. GBL employs games to promote learning, skill acquisition, and training (Boyle et al., 2011). Among the existing types of business games (Wolfe, 1993), the MG is categorized as an executive management game. In the MG, participants play the role of top company executives, responsible for the operation of the entire organization. The types of operations that players need to carry out include purchasing materials, selling and buying products, hiring employees and salespersons, investing in equipment, advertising products, investing in R&D, training employees, securing financing capital, and elaborating financial reports. One game board allows up to six people to play together and compete for the accumulated profit earned from four accounting periods, for two days.

One distinct feature of MG is the use of matrix accounting to compute game scores. The general theory of matrix accounting, with applications to double-entry bookkeeping, is illustrated by Rossi (1889) in a study titled '*Lo scacchiere anglo-normanno e la scrittura in*

partita doppia a forma di scacchiera', which translates to 'The Anglo-Norman exchequer and the double-entry bookkeeping in the form of a chessboard'. Followed by this accounting system, all transactions in which participants engage are initially recorded in a journal, which does not apply the double-entry format but a cashbook format that reports all cash inflows and outflows. Then, all records in the journal are translated into a score sheet using matrix accounting, and participants calculate the financial position and performance of the company.

Numerous studies have investigated matrix accounting, and research predicted an evolution in accounting practice that never materialized (Mattessich & Galassi, 2000; Hughes, 2016). Despite this situation, matrix accounting was adopted for MG, because Nishi believed that matrix accounting would allow participants to save time when recording game scores (calculating profit), as matrix accounting is more efficient than the double-entry bookkeeping system (Koshimura & Nishi, 1979; Nishi, 1988).

3.3 Data Collection

An open-ended questionnaire was administered to collect qualitative data regarding participant perceptions of MG and its learning efficacy. Thus, the following question is asked:

Question: What is your perception of the matrix accounting incorporated in MG? Please describe your perception of matrix accounting in general, including its pros and cons.

The questionnaire asks participants to answer this item by writing a few sentences. It also includes several questions regarding their demographic characteristics.

3.4 Participants

All data were collected from businesspersons who participated in the MG workshop on February 25, 2017. A total of 69 people attended the two-day workshop for training in business and accounting skills and competencies. After the second day, 30 minutes were allocated to participants for responding to our questionnaire. Out of 69 participants, 58 agreed to respond to our non-anonymous questionnaire. As a result, the effective response rate of this survey was 84.06%. The demographics of the participants are shown in Table 1. The majority of the participants are male (82.76%). The sample meets the recommended size for similar exploratory studies (Ajzen & Fishbein, 1980; Ajzen & Madden, 1986; Goh & Ritchie, 2011). In terms of the corporate roles of participants, the most dominant position (55.17%) is that of chief executive officers (CEO) of small and medium enterprises (SMEs),

Table 1. Demographics of Participants

Age	Max	Min	Mean		
	79	25	46.875		
Game Experience	Max	Min	Mean (Std. Dev)		Median
(Game days)	250	6	59.30 (49.07)		46
Gender	Male	Female	Total		
	48 (82.76%)	10 (17.24%)	58 (100.00%)		
Position	SME CEO	SME Executive	SME Employee	Others	Total
	32 (55.17%)	10 (17.24%)	13 (22.42%)	3 (5.17%)	58 (100.00%)

followed by SME employees and management executives as the second and third largest populations, respectively. The sample companies are all SMEs and do not comprise any large public company.

3.5 Data Analysis

In the analysis, the authors began by reading each description, and then created preliminary line-by-line comments while defining the label for each comment. This is referred to as a descriptive coding step (King and Horrocks, 2010). In this study, the descriptive code is called "Contextual Comments." This step was followed by an interpretative coding procedure, where the descriptive codes were clustered, and the meanings of these clusters were interpreted in conjunction with the research question (King and Horrocks, 2010). This interpretative code is also called "Components." The final step of the analysis defined several overarching themes. Such themes were identified by constructing interpretative codes and were reviewed and refined in this step. The final form of the themes should be at a higher level of abstraction than the interpretative codes (King and Horrocks, 2010). In this study, we constructed several sub-themes associated with the main theme. A computer software package known as Atlas.ti was used for the coding process.

3.6 Quality Check

In qualitative research, including thematic analysis, there is no general agreement about which criteria to use when assessing quality or how to apply the qualitative methods to the criteria that are normally used for quantitative research (King and Horrocks, 2010). We employ a set of key criteria advocated by Guba and Lincoln (1989). Their set of criteria

contains four quality items used as an alternative to the primary criteria employed in quantitative research: credibility, transferability, trackable variance, and confirmability. The data used in this study reflect these four criteria.

4. Results

4.1 APPLICABILITY

Four themes emerged from our analysis (Figure 1). The first theme obtained from the data is the applicability of matrix accounting to business practices (applicability). This theme showed that some respondents adopted matrix accounting in their companies (n = 14: 19.18% in Table 3). According to their responses, they installed matrix accounting as their firm's accounting system because they were keen to use the analytical skills they and their employees learned from the MG workshop. For instance, this is illustrated by Participant P 14's account:

> *'Our company prepares financial statements by using matrix accounting, which is aggregated from raw accounting data of the company (P14)'.*

P14 prepares a financial statement based on matrix accounting because the information of this statement assists his/her managerial decision making. Similarly, P8 uses data from matrix accounting to determine how to trace back the steps in the profit calculation, and P39 has applied matrix accounting as their internal accounting system to obtain data for tax

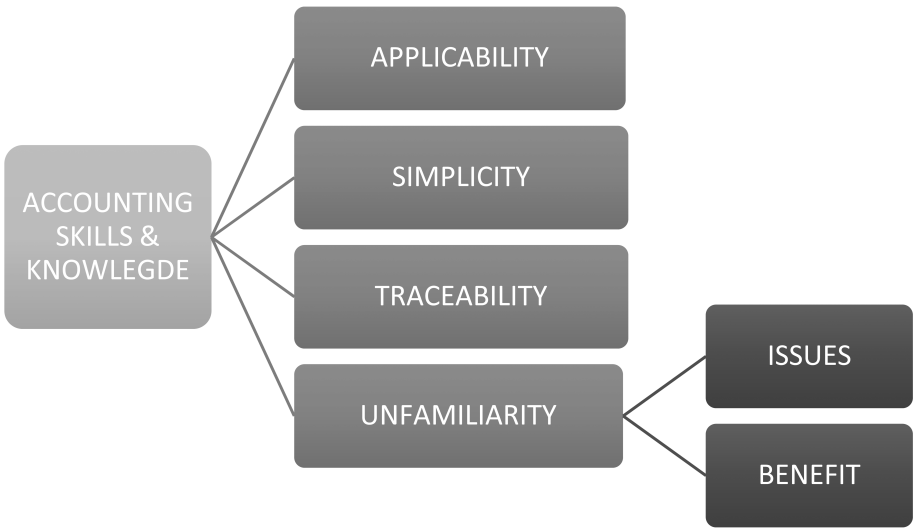

Figure 1. Themes for Matrix Accounting

return purposes (see Table 2). These accounts demonstrate the significant impact of "applicability" in matrix accounting on the development of accounting skills and knowledge in business practice. This association is illustrated by P24's account:

> *'We play MG to master matrix accounting. Eventually, MG provides us simulated experiences of both enjoyment and hardship in management. The point is that game outcomes regarding what scores we get and whether or not we win do not really matter. The best part is that we can master accounting skills through this experience (P24)'.*

Table 2. Themes of Matrix Accounting within the MG

Theme/Sub-Theme	Example of Code	Frequency
APPLICABILITY	As a result of learning matrix accounting, we now know how to trace back how the profit is calculated (P8). Our company prepares a matrix accounting statement that is constructed from raw accounting data of the company (P14). My company has applied matrix accounting since 1983. I basically use this data specifically for calculating tax returns (P39). Learning matrix accounting enabled me to capture the current situation of the business as well as a summarized version of the financial report (P40).	14/73 (19.18%)
SIMPLICITY	We do not need judgment when we deal with transactions on the matrix. We can produce an income statement and balance sheet systematically without any further thoughts (P6). Matrix accounting is simple and easy to understand even for beginners (P42). With matrix accounting, anyone can understand and deal with accounting (P57).	19/73 (26.03%)
TRACEABILITY	Income statements, balance sheets, and cash flow statements are all included in one sheet of paper (P21; P26; P28). Even a quick glance at one matrix sheet will give us a better summary of the firm's financial situation (P30). Matrix accounting presents what the double-entry bookkeeping system does not (P51).	22/73 (30.14%)
UNFAMILIARITY		20/73 (27.40%)
ISSUES	It is necessary to get used to matrix accounting; thus, beginners must be very frustrated (P10). For those who already know about double-entry bookkeeping system, it might take a long time to prepare financial statements by using matrix accounting (P18). You need some training before you fully understand how to record and present matrix accounting (P40).	16/73 (21.92%)
BENEFIT	Handwriting exercises and pencil-pushing calculations for matrix accounting allow learners to understand the process of accounting slowly but solidly (P7). Pencil-pushing exercises involved in matrix accounting enhance deep learning (P43).	4/73 (5.48%)

The authenticity of MG increases the applicability of matrix accounting in real business settings. In this sense, the efficacy of using matrix accounting as a training tool is identified by respondents in terms of learning accounting skills, which indicates that applicability is considered essential for developing accounting skills and knowledge.

4.2 SIMPLICITY

The second theme is referred to as simplicity. Several respondents emphasized the simplicity of matrix accounting and its simplifying role when elaborating financial statements (n = 19: 26.03% in Table 2). Other subjects argued that matrix accounting makes accounting more accessible, even for primary school students (P13; P17), pupils (P45), and anyone with basic mathematical knowledge (P38). More specifically, P55 explained this as a reason to avoid double-entry bookkeeping:

> *'The good thing about using matrix accounting is that even those who don't know how to keep transactions using journal entries can deal with accounting (P55)'.*

In the MG, matrix accounting is used for calculating scores. In this process, players must record the financial information of all transactions completed during the game. The result sheet does not adopt the double-entry format but a cashbook format that records all cash inflows and outflows. Then, all transaction records reported in the journal are copied into a score sheet using matrix accounting. This method avoids the complexity of the double-entry bookkeeping system and reduces player workload when keeping a record of transactions. Also, the types of transactions that players must deal with in the MG are limited since MG is a simulation business game designed to avoid undue complications. P6 described this trait as follows:

> *'We do not need judgment when we deal with transactions on the matrix. We can produce income statements and balance sheets systematically without any thought (P6)'.*

Simplicity certainly helps introduce accounting to those who have never learned accounting. The simplicity of matrix accounting has a strong impact on the ability to develop accounting skills and knowledge as even an accounting novice can have easy access to accounting concepts and practice.

4.3 TRACEABILITY

The third theme for matrix accounting is traceability. The codes aggregated in this theme are the largest among all four themes (n= 22: 30.14% in Table 2). Many respondents

appreciated this characteristic since all financial data are contained in one sheet of matrix accounting. Participants P28 and P51, for example, described this aspect as follows:

> *'The good thing is that the matrix accounting sheet allows us to observe accounting data visually. Income statements, balance sheets, and cash flow statements are all included in one sheet of paper (P28)'.*

> *'Matrix accounting presents what double-entry bookkeeping system does not (P51)'.*

Because of this unique feature of the matrix accounting score sheet, MG players learn how to trace back the steps involved in computing the profit associated with each transaction. Many respondents stated that using this skill helped them capture associations between figures in different financial statements (P57), understand all flows of transactions with a short glance at the score sheet (P57), and obtain a quick summary of the financial position and performance of the company (P30). This indicates that the traceability of matrix accounting has a substantial impact on building accounting skills and knowledge.

4.4. UNFAMILIARITY

The last theme that emerged from the data is labelled "unfamiliarity," which comprises two sub-themes we termed "issues" and "benefit." "Issues" describe the problems caused by unfamiliarity with matrix accounting incorporated in MG and represents the usual notion of unfamiliarity (n = 16; 21.92% in Table 2). For example, participant P18 stressed the difference between the matrix approach and double-entry bookkeeping. Due to this difference between the two approaches, people need time to learn and get used to matrix accounting. This is illustrated in his account as follows:

> *'For those who already know about double-entry book keeping system, it might take a long time to prepare financial statements by using matrix accounting (P18)'.*

P40 also argued that unfamiliarity with matrix accounting is its primary disadvantage, and he highlighted the need for training to master matrix accounting (Table 2). In contrast, other respondents suggested that unfamiliarity generates opportunities to learn the skills needed for business. This type of response corresponds to the "benefit" sub-theme. Although the number of codes classified in this group is minimal (n = 4: 5.48% in Table 2), this aspect is contextually important. With respect to this sub-theme, P15 confirmed that tedious training to master unfamiliar matrix accounting is an essential aspect for successful and deep learning in accounting:

'By preparing financial statements as score sheets (using matrix accounting), every player of the MG, who behaved as a CEO of a company in the game, can analyze what was right, what was wrong, and what should have been done, and understand how financial statements were consequently affected by all actions and transactions. It takes a while to close accounts and make financial statements (by using matrix accounting), so people always suggest converting this process of computing figures and numbers from manual to computer. But I think it is wrong. Pencil-pushing practice (of preparing financial statements) makes us learn better (P15)'.

Other participants, such as P7 and P43 (Table 2), also stated similar perceptions about the positive side of tedious and repetitive practices to master matrix accounting. Unfamiliarity is regarded as a negative side of matrix accounting by some respondents, but this trait seems to unintentionally help MG players learn accounting.

Furthermore, unfamiliarity with matrix accounting gives fresh insight that would not be available by exclusively relying on DEB. This trait helps participants focus more easily on the analysis and interpretation of financial data rather than the processes of developing financial statements (e.g., journal entry). Unfamiliarity has a strong impact on the perceived simplicity of matrix accounting, which allows people with no accounting background to easily access business and accounting materials. Moreover, unfamiliarity with matrix accounting is strongly associated with traceability, which allows reporting all financial statements in only one sheet. The format of matrix accounting is unfamiliar because it does not apply the double-entry bookkeeping system, but the figures in the statements are easy to interpret because the matrix format is characterized by its traceability. This trait requires MG players to trace back how profits were computed from each transaction. In this context, the theme of unfamiliarity, along with simplicity and traceability, is associated with a higher likelihood of developing accounting skills and knowledge.

5. Interpretation

Our analysis indicates that there are four themes underlying matrix accounting as incorporated in the MG. Each theme represents some characteristics of matrix accounting, and they are all positively associated with developing accounting skills and knowledge (see Figure 1). Participants in this study perceived matrix accounting as a useful training tool when adopted for business training and education. Several respondents revealed that they have already adopted matrix accounting in the accounting system of their companies (applicability). Their motivation was to make use of the accounting skills learned at the MG workshop in their business practice. This suggests that they are accustomed to using the matrix format through their gameplay. Although scholars actively researched matrix

accounting since the 1960s, the adoption of matrix accounting in a real accounting setting has been largely neglected (Hughes, 2016). Recent matrix accounting studies, including Vysotskaya et al. (2016), address the validity of matrix accounting for accounting education in a formal education setting, but do not assess the effect of the adoption of matrix accounting in the context of training and education for individuals in the workplace.

We also find that two other themes, simplicity and traceability, contribute to effectively learning accounting skills and knowledge. These characteristics are consistent with the intention to adopt matrix accounting in the MG as proposed by Nishi, who argues that matrix accounting saves time in recording game scores and helps calculate profit and analyze outcomes more effectively and efficiently than the double-entry bookkeeping system (Nishi, 1988). The simplicity and traceability of matrix accounting are further supported by previous studies (e.g., Corcoran, 1964; Faux, 1966). Historically, matrix accounting has been utilized as teaching material because the adaptation of matrices to bookkeeping brings a simplification that benefits the learning process (Faux, 1966). The traceability of matrix accounting is also appreciated because this trait contributes to reducing workload and time (Corcoran, 1964). Our study shows that these historical characteristics of matrix accounting can be found in the MG, thus allowing participating players (businesspersons) to effectively learn accounting skills.

Furthermore, simplicity and traceability are defined through comparison with double-entry bookkeeping accounting. Matrix accounting is found to be simpler and more comprehensive as an accounting training tool than double-entry bookkeeping. However, such differences give rise to the theme of unfamiliarity. This theme indicates that matrix accounting is unfamiliar and difficult to get used to because it is not adopted in current accounting practice, as it is merely a theoretical construct. Unfamiliarity can be a strong drawback (‘issues’) and may discourage people from mastering accounting skills because it requires additional time and effort. However, our findings point to an unintended effect (‘benefit’) of this drawback obtained by using tedious training exercises to master unfamiliar matrix accounting. In line with our study, Ijiri (1983) argues that a certain amount of pencil-pushing practice is essential for learning accounting. Ijiri (1983) also emphasizes the importance of jogging-like exercises because this type of activity boosts the specific skills and mental abilities required in different phases of accounting. However, this practice is significantly reduced by the use of computers. In our study, many respondents highlighted the importance of pencil-pushing training in matrix accounting to develop solid accounting skills and knowledge. Further, Vysotskaya et al. (2016) describe the advantages of incorporating matrix accounting into accounting education, thus providing an alternative to the double-entry bookkeeping approach. Therefore, the unfamiliarity of matrix accounting may in fact support the effectiveness of the MG as a training tool.

6. Conclusions

This study investigates the recent adoption of matrix accounting for business training and education by conducting an inductive exploratory analysis based on data collected from a survey for this purpose. Our findings confirm the existence of several themes that are then used to develop a theoretical construct, which indicates that four primary characteristics of matrix accounting (applicability, simplicity, traceability, and unfamiliarity) significantly contribute to developing solid accounting skills and knowledge. Our findings also imply that matrix accounting is highly appreciated as entry material for accounting education among the participants surveyed, compared to the DEB. Furthermore, teaching matrix accounting in the first course of tertiary school as an alternative to DEB is of great interest, as our findings support the idea that learning matrix accounting would help the development of high order cognitive skills (e.g., deep learning and thinking skills). Teaching matrix accounting as an alternative to DEB may allow new accounting students to develop their thinking skills more effectively. In this sense, matrix accounting raises a question regarding the debate on the efficacy of DEB in introductory accounting courses, including entry-level accounting education at secondary schools (Creig, 2018; Sangster, 2010; Pincus, 1997; Saudagaran, 1996; Keef & Hooper, 1991).

Future research needs to verify this theoretical construct by using other data and methodologies. How each of the four themes that characterize matrix accounting is associated with the actual development of accounting expertise is of great interest. The results of this exploratory study cannot be generalized to the entire population. Future research may use qualitative items and conduct further statistical tests to quantify the exploratory results and assess the extent to which they may be generalized. Quantitative research that incorporates a large-scale survey of randomly selected MG participants is required to ensure the general validity of the proposed construct.

As with any study of this nature, there are several limitations. First, the findings and themes should be seen as tentative and requiring further investigation. Regarding our findings, the most obvious limitation is related to the descriptive responses obtained from the questionnaire participants. Although our survey adopted open-ended question items to evaluate the target issues, it is not clear whether the structure of our questionnaire allows us to sufficiently capture the information from the in-depth accounts provided by the subjects. Second, since the whole sample is relatively small and belongs to a single institution (the MG game club), the generalizability of the results is limited. Recently, however, the MG has been introduced in other countries (e.g., Thailand, China, and the United States). Therefore, future studies may implement data collection in these regions to address the generalizability issue.

Apart from the above limitations, this exploratory study is a first step to identify salient

beliefs about matrix accounting before conducting a follow-up quantitative analysis. This study also contributes to the accounting literature by providing evidence of the benefits of the recent adoption of matrix accounting in the real world. These findings are of significant value in the historical development of the practice of accounting.

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